

have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from June 29 to July 7.

The greatest number of reports were received for the following dates: 19th, 11, and 21st, 10.

Reports were most numerous from Ohio, 10; Minnesota, 9.

In Canada.—Auroras were reported as follows: Father Point, 17, 21, 22; Quebec, 5, 6, 21, 22; Montreal, 21; Toronto, 6, 19; Winnipeg, 20; Minnedosa, 13, 17, 19, 20, 21, 22, 23, 24, 25; Qu'Appelle, 19, 20, 21; Banff, 6, 24; Prince Albert, 19, 20, 22, 23.

Thunderstorms were reported as follows: Halifax, 1; Grand Manan, 4, 24; Yarmouth, 4, 5, 9, 15; Charlottetown, 3; Chatham, 3; Father Point, 2, 3, 8, 25, 29; Quebec, 3, 10, 20, 21, 23, 25, 29, 30; Montreal, 3, 8, 18, 19, 20, 23, 25; Rockliffe, 19; Toronto, 3, 8, 17, 19, 25, 28; White River, 2, 7, 8, 14, 17, 18, 20, 23, 28; Port Stanley, 3, 8, 25, 30; Parry Sound, 8, 28; Port Arthur, 2, 5, 6, 7, 14, 22, 27; Winnipeg, 3, 5, 6, 11, 14, 18, 27; Minnedosa, 4, 5, 11, 12, 14, 17, 24, 26; Qu'Appelle, 17; Medicine Hat, 12, 30; Swift Current, 2, 8, 10, 13, 16, 23, 27, 29; Banff, 12, 13, 16, 25; Prince Albert, 1, 5, 17, 29; Bermuda, 24.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 80.0°, or about normal; the highest was 103°, at Hamilton on the 1st, and the lowest, 51°, at Madison on the 12th. The average precipitation was 6.06, or 1.13 above normal; the greatest monthly amount, 11.27, occurred at Eufaula, and the least, 3.95, at Tusculumbia.—*F. P. Chaffee.*

Arizona.—The mean temperature was 83.5°; the highest was 123°, at Fort Mohave on the 28th, and the lowest, 40°, at Prescott on the 19th. The average precipitation was 2.44; the greatest monthly amount, 8.86, occurred at Bisbee, while none fell at Fort Mohave and Yuma.—*W. T. Blythe.*

Arkansas.—The mean temperature was 79.9°, or about normal; the highest was 105°, at Conway on the 22d, and the lowest, 50°, at Fayetteville on the 12th and 13th, and at Oregon on the 11th. The average precipitation was 4.25, or 0.38 below normal; the greatest monthly amount, 13.97, occurred at Pond, and the least, 0.60, at Texarkana.—*E. B. Richards.*

California.—The mean temperature was 81.4°, or about normal; the highest was 124°, at Volcano Springs on the 13th, and the lowest, 27°, at Bodie on the 2d and 25th. The average precipitation was less than 0.01, or 0.04 below normal; the greatest monthly amount, 0.22, occurred at San Jacinto, while no rain fell at more than half of the stations.—*W. H. Hummon.*

Colorado.—The mean temperature was 67.7°, or about 1.0° above normal; the highest was 109°, at Fort Morgan on the 18th, and the lowest, 29°, at Steamboat Springs on the 23d, 29th, and 30th. The average precipitation was 2.14, or 0.07 below normal; the greatest monthly amount, 4.75, occurred at Altman, while none fell at Steamboat Springs.—*F. H. Brandenburg.*

Georgia.—The mean temperature was 79.8°, or nearly normal; the highest was 104°, at Millen on the 1st, and the lowest, 47°, at Diamond on the 12th. The average precipitation was 8.14, or 2.32 above normal; the greatest monthly amount, 15.45, occurred at Leverett, and the least, 4.31, at Americus.—*J. B. Morbury.*

Idaho.—The mean temperature was 66.6°; the highest was 105°, at Nampa on the 11th, and the lowest, 28°, at Gray on the 2d, and at Marysville on the 17th. The average precipitation was 0.39; the greatest monthly amount, 2.00, occurred at American Falls, and the least, trace, at Nampa.—*D. P. McCallum.*

Illinois.—The mean temperature was 75.5°, or about normal; the highest was 102°, at Alexander on the 24th, and the lowest, 41°, at Lanark on the 11th. The average precipitation was 2.93, or 0.82 below normal; the greatest monthly amount, 7.52, occurred at St. John, and the least, 0.29, at Dwight.—*C. E. Linney.*

Indiana.—The mean temperature was 76.4°, or 1.5° above normal; the highest was 102°, at Bright on the 3d, at Salem on the 24th, and at Winamac on the 26th; the lowest was 42°, at Bluffton and Cambridge City on the 11th, and at Winamac on the 10th and 11th. The average precipitation was 3.02, or 0.30 below normal; the greatest monthly amount, 5.55, occurred at Vevay, and the least, trace, at Bedford.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 73.4°, or about normal; the highest was 102°, at Clarinda on the 19th, and at Rock Rapids on the 24th, and the lowest, 42°, at Ames on the 11th, and at Neola on the 31st. The average precipitation was 2.98, or slightly below normal; the greatest monthly amount, 12.88, occurred at Thurman, and the least, 0.55, at Pioneer.—*G. M. Chappel.*

Kansas.—The mean temperature was 77.7°, or 0.6° below normal;

the highest was 108°, at Hays and Russell on the 27th, and the lowest, 46° at Hoxie on the 18th. The average precipitation was 3.00, or 0.31 below normal; the greatest monthly amount, 6.80, occurred at Oswego, and the least, 0.38, at Gibson.—*T. B. Jennings.*

Kentucky.—The mean temperature was 77.8°, or 0.9° above normal; the highest was 102°, at Russellville and Williamsburg on the 2d, at Shelby City on the 3d, and at Maysville on the 4th; the lowest was 48°, at Loretto on the 11th, and at Maysville on the 12th. The average precipitation was 4.71, or 0.14 above normal; the greatest monthly amount, 12.10, occurred at Vanceburg, and the least, 0.44 at Irvington.—*G. E. Hunt.*

Louisiana.—The mean temperature was 80.9°, or 0.8° below normal; the highest was 103°, at Liberty Hill on the 21st, and the lowest, 55°, at Robeline on the 14th. The average precipitation was 5.84, or 1.21 above normal; the greatest monthly amount, 11.99, occurred at Clinton, and the least, 2.94, at Plain Dealing.—*E. A. Beals.*

Maryland and Delaware.—The mean temperature was 77.5°, or 2.1° above normal; the highest was 109°, at Boettcherville, Md., on the 3d, and the lowest, 33°, at Deepark, Md., on the 11th. The average precipitation was 3.65, or 0.80 below normal; the greatest monthly amount, 7.77, occurred at Grantsville, Md., and the least, 1.31, at Cumberland, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 69.9°, or 1.2° above normal; the highest was 101°, at Clinton and Mottville on the 24th, and the lowest, 25°, at Baldwin on the 11th. The average precipitation was 1.57, or 1.02 below normal; the greatest monthly amount, 4.55, occurred at St. Ignace, and the least, 0.15, at Fitchburg.—*C. F. Schneider.*

Minnesota.—The mean temperature was 69.8°, or about normal; the highest was 101°, at Wabasha on the 24th, and the lowest, 38°, at Mount Iron on the 6th, at Koochiching on the 10th, and at Folden on the 18th. The average precipitation was 2.94, or about 0.50 below normal; the greatest monthly amount, 9.40, occurred at Beardsley.—*T. S. Outram.*

Mississippi.—The mean temperature was 80.5°, or 0.8° below normal; the highest was 104°, at Columbus on the 22d, and the lowest, 53°, at French Camp on the 13th. The average precipitation was 5.92, or 2.08 above normal; the greatest monthly amount, 12.91, occurred at Walnutgrove, and the least, 1.57, at Greenville.—*R. J. Hyatt.*

Missouri.—The mean temperature was 76.1°, or 0.5° below normal; the highest was 104°, at Princeton on the 24th, and the lowest, 42°, at Potosi on the 12th. The average precipitation was 5.58, or 1.03 above normal; the greatest monthly amount, 15.06, occurred at Edgehill, and the least, 1.97, at Unionville.—*A. E. Hackett.*

Montana.—The mean temperature was 66.0°, or about 1.0° below normal; the highest was 104°, at Fort Keogh on the 26th, and the lowest, 31°, at Castle on the 2d. The average precipitation was 0.58 above normal; the greatest monthly amount, 3.32, occurred at Yale, and the least, 0.40, at Glendive and Radersburg.—*E. J. Glass.*

Nebraska.—The mean temperature was 74.0°, or more than 1.0° below normal; the highest was 108°, at Bluehill on the 24th, and the lowest, 35°, at Gering on the 5th. The average precipitation was 2.12, or about 1.40 below normal; the greatest monthly amount, 11.53, occurred at Plattsmouth, and the least, trace, at Fairmont and Valparaiso.—*G. A. Loveland.*

Nevada.—The mean temperature was 73.5°, or 0.6° below normal; the highest was 114°, at St. Thomas on the 28th, and the lowest, 34°, at Elko on the 1st. The average precipitation was 0.12, or about half the usual amount; the greatest monthly amount, 0.96, occurred at Panaca, while none fell at many stations.—*R. F. Young.*

New England.—The mean temperature was 70.0°, or 1.2° above normal; the highest was 103°, at Middletown, Conn., on the 3d, and the lowest, 30°, at Flagstaff, Me., on the 12th. The average precipitation was 3.85, or 0.52 above normal; the greatest monthly amount, 10.26, occurred at Providence, R. I., and the least, 0.66, at Eastport, Me.—*J. W. Smith.*

New Jersey.—The mean temperature was 75.3°, or about 2.5° above normal; the highest was 107°, at Somerville on the 3d, and the lowest, 38°, at Charlotteburg on the 11th. The average precipitation was 4.96, or 0.68 above normal; the greatest monthly amount, 11.72, occurred at Asbury Park, and the least, 2.23, at Atlantic City.—*E. W. McGunn.*

New Mexico.—The mean temperature was 72.5°, or 1.4° below normal; the highest was 105°, at Deming on the 30th, and the lowest, 37°, at Winsors on the 16th. The average precipitation was 3.86, or 1.18 above normal; the greatest monthly amount, 6.56, occurred at Fort Bayard, and the least, 0.90, at Bernalillo.—*R. M. Hardinge.*

New York.—The mean temperature was 72.5°, or 2.4° above normal; the highest was 103°, at Primrose and Westpoint on the 3d, and the lowest, 32°, at Franklinville, New Lisbon, and South Kortright on the 11th, and at Elizabethtown and Perry City on the 12th. The average precipitation was 2.80, or 1.03 below normal; the greatest monthly amount, 8.90, occurred at Liberty, and the least, 0.60, at Madison Baracks.—*R. G. Allen.*

North Carolina.—The mean temperature was 77.7°, or normal; the highest was 103°, at Goldsboro on the 2d, and the lowest, 49°, at Highlands on the 12th. The average precipitation was 6.98, or about 1.50 above normal; the greatest monthly amount, 15.97, occurred at Highlands, and the least, 1.97, at Goldsboro.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 67.5°, or 1.2° below normal; the highest was 106°, at Medora on the 5th, and the lowest, 28°, at Fort Yates on the 30th. The average precipitation was 2.74, or 0.37 above normal; the greatest monthly amount, 6.30, occurred at Wahpeton, and the least, 0.25, at Minot.—*B. H. Bronson.*

Ohio.—The mean temperature was 76.0°, or 2.8° above normal; the highest was 105°, at Warsaw on the 1st, and the lowest, 38°, at Greenhill and Milligan on the 11th. The average precipitation was 3.98, or 0.40 above normal; the greatest monthly amount, 10.65, occurred at Vanceburg, Adams County, and the least, 1.52, at Jacksonboro.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 80.0°; the highest was 112°, at Purcell on the 8th, and the lowest, 51°, at Burnett on the 12th, and at Prudence and Sac and Fox Agency on the 13th. The average precipitation was 4.44; the greatest monthly amount, 9.82, occurred at Arapaho, and the least, 1.65, at Sac and Fox Agency.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 66.0°, or 0.4° above normal; the highest was 119°, at Prineville on the 29th, the highest temperature ever recorded in Oregon; the lowest was 29°, at the same station on the 7th. The average precipitation was 0.46, or 0.02 below normal; the greatest monthly amount, 1.82, occurred at Government Camp, and the least, trace, at Ella and Umatilla.—*B. S. Pagus.*

Pennsylvania.—The mean temperature was 74.8°, or 3.9° above normal; the highest was 107°, at Hamburg on the 3d, and the lowest, 33°, at Shinglehouse on the 11th. The average precipitation was 3.36, or 0.62 below normal; the greatest monthly amount, 6.29, occurred at Point Pleasant, and the least, 1.15, at Williamsport.—*T. F. Townsend.*

South Carolina.—The mean temperature was 80.0°, or 1.2° above normal; the highest was 102°, at Greenwood on the 4th, and the lowest, 54°, at Little Mountain on the 12th. The average precipitation was 7.81, or 1.68 above normal; the greatest monthly amount, 12.99, occurred at Charleston, and the least, 4.72, at Effingham.—*J. W. Bauer.*

South Dakota.—The mean temperature was 71.9°, or about normal;

the highest was 112°, at Cherry Creek on the 5th, and the lowest, 32°, at Rochford on the 3d. The average precipitation was 3.06, or 0.15 above normal; the greatest monthly amount, 6.92, occurred at Wessington Springs, and the least, 0.19, at Nowlin.—*S. W. Glenn.*

Tennessee.—The mean temperature was 77.8°, or slightly above normal; the highest was 104°, at Elizabethton on the 2d, and the lowest, 51°, at Erasmus on the 11th, and at Springdale on the 12th. The average precipitation was 5.92, or about 1.25 above normal; the greatest monthly amount, 10.56, occurred at Sewanee, and the least, 2.09, at Covington.—*H. C. Bate.*

Texas.—The mean temperature for the State determined by comparison of 36 stations distributed throughout the State, was 1.2° below the normal. There was a general deficiency, but the deficit was slight in many localities. The highest was 110°, at Fort Ringgold and Fruitland on the 23d, and the lowest, 47°, at Valentine on the 2d. The average precipitation for the State, determined by comparison of 38 stations distributed throughout the State, was 0.08 below the normal. There was a slight excess over the panhandle, the east coast districts, and southwest Texas, while there was a general deficiency elsewhere, but not amounting to more than 1.00 except in a few localities over north Texas. The greatest monthly amount, 5.88, occurred at Breckenridge, while none fell at Rockport.—*I. M. Cline.*

Utah.—The mean temperature was 73.4°; the highest was 115°, at St. George on the 29th, and the lowest, 28°, at Soldier Summit on the 1st. The average precipitation was 0.35; the greatest monthly amount, 1.62, occurred at Levan, and the least, trace, at several stations.—*J. H. Smith.*

Virginia.—The mean temperature was 77.0°, or slightly above normal; the highest was 105°, at Bon Air on the 2d, and at Woodstock on the 3d, and the lowest, 44°, at Dale Enterprise and Hot Springs on the 11th. The average precipitation was 5.33, or 1.72 above normal; the greatest monthly amount, 13.74, occurred at Dwale, and the least, 2.27, at Stephens City.—*E. A. Evans.*

Washington.—The mean temperature was 64.9°, or about normal; the highest was 107°, at Centerville on the 31st, and the lowest, 33°, at Centerville on the 6th, and at Hunters on the 18th. The average precipitation was 0.54, or slightly below normal; the greatest monthly amount, 1.97, occurred at Clearwater, while none fell at several stations in the Yakima Valley.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 75.0°; the highest was 103°, at Martinsburg and Wheeling on the 3d, and the lowest, 40°, at Beverly, Burlington, Dayton, and Uppertract on the 11th, and at New Martinsville on the 12th. The average precipitation was 4.46; the greatest monthly amount, 8.33, occurred at Beverly, and the least, 1.53, at Rowlesburg.—*C. M. Strong.*

Wisconsin.—The mean temperature was 70.7°, or slightly above normal; the highest was 101°, at Medford on the 14th, and the lowest, 34°, at Neillsville on the 11th. The average precipitation was 2.87, or slightly above normal; the greatest monthly amount, 5.89, occurred at Westfield, and the least, 0.55, at Bayfield.—*W. M. Wilson.*

Wyoming.—The mean temperature was 67.4°; the highest was 105°, at Bittercreek on the 15th, and the lowest, 30°, at Four Bear on the 2d. The average precipitation was 0.86; the greatest monthly amount, 2.34, occurred at Wheatland, and the least, trace, at Wamsutter.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

CLIMATOLOGY VERSUS METEOROLOGY.

By Prof. MILTON WHITNEY, Chief of Division of Soils.

I have been much interested in reading the criticisms of the recent article of mine¹ contained in the April number of the MONTHLY WEATHER REVIEW, page 168, and that of Mr. R. DeC. Ward in the MONTHLY WEATHER REVIEW for May, page 214. These criticisms have brought out some very interesting additional facts. It is evident, however, that the main purpose of my paper was not clearly understood. The point I wished to make was the distinction between meteorology and climatology in order to emphasize the fact that we are not paying enough attention to the study of climatology. My definition of meteorology would be (a) the numerical data as expressed by our instruments of the various atmospheric phenomena at or near the surface of the earth; (b) the investigation of the laws of storm, of temperature, humidity, rainfall, light intensity, and other natural

phenomena of the kind. Climatology, on the other hand, is the numerical relation of these phenomena as they concern the development of life and of industries as you properly suggested. The collection and tabulation of meteorological data does not meet this definition of climatology, and it is this that I particularly desired to emphasize. From the equation published in Science, it is evident that certain functions of temperature are numerically equal to certain other functions of humidity, wind velocity, and moisture as expressed in the development of plants; that is, in order to maintain a constant condition of plant growth, an increase of a few degrees of temperature must be followed by a fall in the velocity of the wind or by an increase in the humidity of the atmosphere, or by an increase in the moisture supply of the soil. All of these factors have more or less effect, according to the intensity of the heat and actinic effects of the solar radiations.

In calling attention to this it was desired to interest our meteorologists, if possible, in this study of the numerical relations of this phenomenon. We all know that if the

¹Climatology as distinguished from meteorology. Science, January 25, 1898, VII, p. 113.